POLICY RESEARCH WORKING PAPER 2381

Savings and the Terms of Trade under Borrowing Constraints

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When households face the possibility of borrowing constraints in bad times, favorable movements in the *permanent* component of the terms of trade may lead to higher rates of private savings.

The World Bank
World Bank Institute
Economic Policy and Poverty Reduction
June 2000

POLICY RESEARCH WORKING PAPER 2381

Summary findings

Agénor and Aizenman examine the extent to which permanent terms-of-trade shocks have an asymmetric effect on private savings.

Using a simple three-period model, they show that if households expect to face binding constraints on borrowing in bad states of nature (when the economy is in a long trough rather than a sharp peak), savings rates will respond asymmetrically to favorable movements in the permanent component of the terms of trade—in contrast with the predictions of conventional consumption-smoothing models.

They test for asymmetric effects of terms-of-trade disturbances using an econometric model that controls for various standard determinants of private savings. The results—based on panel data for nonoil commodity exporters of Sub-Saharan Africa for 1980–96 (a group of countries for which movements in the terms of trade have traditionally represented a key source of macroeconomic shocks)—indicate that increases in the permanent component of the terms of trade (measured using three alternative filtering techniques) indeed tend to be associated with higher rates of private savings.

This paper is a product of Economic Policy and Poverty Reduction, World Bank Institute. Copies of the paper are available free from the World Bank, 1818 H Street, NW, Washington, DC 20433. Please contact Tanya Loftus, room J4-282, telephone 202-473-6317, fax 202-676-9810, email address tloftus@worldbank.org. Policy Research Working Papers are also posted on the Web at www.worldbank.org/research/workingpapers. Pierre-Richard Agénor may be contacted at pagenor@worldbank.org. June 2000. (38 pages)

Savings and the Terms of Trade under Borrowing Constraints

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JEL Classification Numbers: D91, F41, O55

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1 Introduction

It is well recognized that the macroeconomic effects of terms-of-trade shocks can be very significant in developing countries. As documented, for instance, by Agénor, McDermott and Prasad (1998), terms-of-trade disturbances are highly correlated with output fluctuations and can be a major source of aggregate economic instability. They also tend to have a large impact on savings (both private and public) in developing economies, in part because they tend to be associated with large income effects.

Terms-of-trade shocks are often induced by sharp changes in world commodity prices. It is well recognized that such changes tend to be asymmetric: positive shocks are more common than negative ones in the sense that the typical pattern is often one of long troughs and sharp peaks (Collier and Gunning (1994)). One reason for this, as formally analyzed in a stock-holding model with intertemporal arbitrage by Deaton and Laroque (1992), is the asymmetry involved in storage: stocks cannot be negative and a stock-out will give rise to sharp movements in prices. As a result, movements in the terms of trade of individual countries have also tended to be asymmetric.

The macroeconomic implications of asymmetric terms-of-trade shocks have received limited attention in open-economy macroeconomics, despite the fact that many economists would agree with the view that the welfare loss from a slump may be different (possibly larger) than the gain from a boom. A key channel through which asymmetric effects can operate is through the existence of borrowing constraints on world financial markets. Specifically, consumers from poor countries may be able to deposit their windfall savings on the international capital market in good times, but they may be unable to borrow in bad times because of collateral problems or a high risk of default. As emphasized by Deaton (1992), this asymmetry can create an incentive for precautionary saving, because in the case of a negative shock consumption can be smoothed only by running down previously accumulated assets. At the same time, however, there is relative scant empirical evidence on potential asymmetric effects of terms-of-trade shocks on private savings. This paper attempts to fill this void by using cross-section econometric regressions for a group of countries for which movements in the terms of trade have traditionally represented a key source of macroeconomic shocks, non-oil exporters of sub-Saharan Africa. This group of countries provides indeed an interesting sample for assessing the possibility that terms-of-trade shocks may exert an asymmetric effect on private savings. Many of these countries derive a large

share of their export earnings from primary commodities. More specifically, primary commodities account on average for about three-fourths of total exports in most of them, and the share of commodities in some countries' exports exceeds 90 percent (see World Bank (2000, Chapter 4)). Fluctuations in the terms of trade have also represented a major source of macroeconomic volatility; Figure 1 for instance shows the correlation between the volatility of real GDP and the volatility of the terms of trade (both weighted and unweighted, as defined in Appendix B) for all the countries in the sample over the estimation period. The figure does suggest a positive association between these variables. In addition, there is also some anecdotal evidence that access to world capital markets by many of these countries (which, to begin with, are relatively closed financially) tends to be asymmetric; it is often in "good times" (periods characterized in particular by high commodity prices and improvements in the terms of trade that private capital tends to flow to low-income countries (see World Bank (1999, Chapter 2)).

The remainder of the paper is organized as follows. Section II discusses analytical issues. It reviews briefly the conventional, consumption-smoothing approach to assessing the effects of terms-of-trade shocks on savings, and considers the role of borrowing constraints in explaining an asymmetric consumption and saving response by private agents to this type of shocks. It elaborates, in particular, on the role of expected borrowing constraints in bad states of nature. Section III discusses the specification of the econometric model used to assess the existence of an asymmetric effect of terms-of-trade movements and describes the estimation technique. Section IV presents the empirical results, based on cross-sectional data covering the period 1980-96 for non-oil exporters of sub-Saharan Africa. The last section summarizes the results, identifies some other factors that may explain an asymmetric response to terms-of-trade shocks, and discusses some possible extensions of the analysis.

2 Analytical Issues

Early contributions to the analysis of the effect of terms-of-trade shocks on saving include those of Harberger (1950) and Laursen and Meltzer (1950). The Harberger-Laursen-Meltzer (HLM) effect predicts a positive relationship between (transitory) changes in the terms of trade and saving, as a result

of consumption smoothing.[1] An adverse *transitory* movement in the terms of trade, for instance, leads to a decrease in a country's current level of income that is larger than the decrease in its permanent income. Consumption smoothing behavior leads therefore to a fall in domestic saving. On the contrary, a *permanent* deterioration in the terms of trade, to the extent that it leads to a concomitant reduction in both current and permanent income, will have no effect on saving. Evidence supporting this view has been provided in a variety of studies. Bevan, Collier and Gunning (1993), for instance, analyzed the impact of the 1976-77 coffee boom (caused by a frost in Brazil) on rural saving in Kenya. They found that proceeds from this boom were fully passed on to farmers, and that about 60 percent of the income windfall was saved.[2]

The possibility of asymmetric effects of terms-of-trade shocks has important implications for the consumption smoothing approach and the behavior of savings rates in the presence of borrowing constraints. To explore some of these implications, we consider a three-period model in which consumers (or households) are identical and live for three periods. Utility is taken to be quadratic, and both the rate of time preference and the real interest rate are set to zero.[3] Specifically, total utility over the lifespan of the typical

[1]The initial formulation by Harberger (1950) and Laursen and Meltzer (1950) relied on a Keneysian-type open economy framework. It was later extended to an intertemporal setting, notably by Obstfeld (1982), and Svensson and Razin (1983), and subsequently Edwards (1989) and Gavin (1990); see also Obstfeld and Rogoff (1997). These contributions also highlighted the distinction between permanent and transitory shocks, and the importance of an endogenous rate of time preference for movements in the terms of trade to generate transitory movements in savings.

[2]As discussed for instance by Ostry and Reinhart (1992) and McDermott and Cashin (1998), if households consume both tradables and nontradables, there will be both intratemporal and intertemporal substitution effects associated with a terms-of-trade shock; these effects may be large enough to offset the conventional effect associated with consumption smoothing considerations. However, Ogaki, Ostry and Reinhart (1996) found that in low-income countries (where levels of income are near the subsistence level) both intratemporal and intertemporal substitution effects have a relatively limited impact on savings; overall, their empirical results supported the view that transitory adverse movements in the terms of trade in these countries tend to lead to a reduction in private saving—as predicted by the Harberger-Laursen-Metlzer effect.

[3]Life-cycle models with borrowing constraints include Hubbard and Judd (1986) and Zeldes (1989). In both of these models, liquidity constraints are imposed exogenously in the form of simple non-negative wealth constraints.

household, V, is given by

$$V = u(c_0, c_1) + u(c_1, c_2) + u(c_2, c_3), \tag{1}$$

where

$$u(c_{h-1}, c_h) = c_h - 0.5\phi c_h^2 - 0.5\tau(c_h - c_{h-1})^2, \tag{2}$$

where c_h is consumption in period h and $\phi, \tau \geq 0$. We assume that ϕ is small enough to ensure that in the relevant region, the marginal utility of consumption is positive. Equation (2) allows for the presence of habit formation – changes in the current level of consumption relative to the previous level entails disutility, proportional to τ. We assume that prior to period 1, both income and consumption are stable, and were expected to remain such. Hence, the initial level of assets at period 1 is zero, and consumption is equal to income, y:

$$y_0 = c_0 = 1.$$

Suppose now that, at the beginning of period 1, there is a change in the underlying stochastic process of income. First, a permanent shock increases income by ε. Second, an adverse transitory shock (induced, for instance, by an adverse movement in the terms of trade) may occur in the second period with probability q, reducing second-period income by δ. Hence, the revised income path is anticipated to be

$$y = \begin{cases} y_h = 1 + \varepsilon, \quad h = 1, 2, 3 & \text{with prob. } 1 - q \\ \\ y_1 = y_3 = 1 + \varepsilon, \quad y_2 = 1 + \varepsilon - \delta & \text{with prob. } q \end{cases} \tag{3}$$

A convenient feature of the model described by equations (1) and (2) is that, in the absence of habit formation ($\tau = 0$), and with a well-functioning capital market, the consumer would behave according to the permanent income hypothesis. That is, if indeed consumers face an adverse transitory shock in period 2, they will borrow in the second period in order to smooth their consumption path. A key issue, however, is whether borrowing is at all feasible. In what follow we evaluate the impact of credit constraints on savings by contrasting two scenarios: the first assumes that consumers have full access to the international capital market, whereas the second considers the case where consumers are unable to borrow, due for instance to perceptions of country sovereign risk.

With full access to the capital market, consumers borrow in period 2 in bad states of nature and repay fully in period 3. The representative consumer's problem is thus, with $x = 1 + \varepsilon$:

$$\max_{s_1, s_2^L, s_2^H} \begin{cases} u(1; x - s_1) \\ q[u(x - s_1; x - \delta + s_1 - s_2^L) + u(x - \delta + s_1 - s_2^L; x + s_2^L)] \\ (1 - q)[u(x - s_1; x + s_1 - s_2^H) + u(x + s_1 - s_2^H; x + s_2^H)] \end{cases} . \quad (4)$$

where s_2^L (respectively s_2^H) denotes second-period savings if the adverse income shock is indeed positive (zero).

The first-order conditions of the above problem provide three linear equations in $s_1, s_2^L s_2^H$, from which we can infer that

$$s_1 = \frac{\delta q(1 + 3\theta)(1 + \theta) + \varepsilon\theta(2 + 5\theta)}{3 + 14\theta(1 + \theta)}, \quad (5)$$

where $\theta = \tau/\phi$ measures the relative importance of habit formation versus the diminishing marginal utility of consumption. Note that

$$s_1|_{\theta=0} = \frac{\delta q}{3}, \quad (6)$$

$$s_1|_{\theta\to\infty} = \frac{3\delta q + 5\varepsilon}{14}, \quad (7)$$

Equation (6) corresponds to the case where habit formation is absent ($\tau = 0$). In these circumstances, savings in period 1 is determined simply by the difference between endowment, given by $x = 1 + \varepsilon$, and permanent income, given by

$$y_P = \frac{x + (x - q\delta) + x}{3} = x - \frac{\delta q}{3}$$

in line with the prediction of the permanent income hypothesis. Consumption in the first period will increase by the permanent increase in income, minus the expected value of the transitory shock, smoothed over the 3 periods of life. Equation (7) corresponds to the other extreme, where adjustment of consumption is extremely costly (or the marginal utility is constant). Note that habit formation implies that a fraction of the permanent shock is saved in the first period, in order to smooth the cost of adjustment across time.

Applying the first-order conditions we infer that, in the absence of habit formation, second-period savings is[4]

$$s_2^L\big|_{\theta=0} = -\frac{\delta(3-q)}{6}. \tag{8}$$

Equation (8) indicates that if an adverse transitory shock does indeed reduce second-period income, agents will borrow to smooth their consumption.

In what follows, we assume that the habit formation parameter ϕ and the permanent shock are not large enough relative to the transitory shock so that $s_2^L < 0$. Suppose, however, that borrowing is not feasible, due (as argued earlier) to country risk considerations. In these circumstances, the maximization problem of the representative household becomes

$$\max_{s_1, s_2^H} \begin{cases} u(1; x - s_1) \\ q[u(x - s_1; x - \delta + s_1) + u(x - \delta + s_1; x)] \\ (1-q)[u(x - s_1; x + s_1 - s_2^H) + u(x + s_1 - s_2^H; x + s_2^H)] \end{cases} \tag{9}$$

Solving this problem, we can infer that the presence of borrowing constraints modifies first-period savings to

$$\tilde{s}_1 = \frac{\delta q(1+3\theta) + \varepsilon\theta}{(2+6\theta)(2+5\theta) - (1-q)(1+4\theta)^2}(2+5\theta). \tag{10}$$

Hence, in the absence of habit formation,

$$\tilde{s}_1\big|_{\theta=0} = \frac{\delta q}{2 - 0.5(1-q)}. \tag{11}$$

Comparing (6) and (11), we find that first-periods saving are higher under borrowing constraints, as the consumer is accumulating assets to reduce the

[4]If there is no habit formation, and if the adverse shock does hit consumers in the second period, the revised permanent income would be

$$y_P = 0.5\ s_1\big|_{\theta=0} + \frac{(x-\delta)+x}{2} = x + \frac{(\delta q/3) - \delta}{2}.$$

Hence, savings would be

$$x - \frac{\delta q}{3} - \delta - \left[x + \frac{(\delta q/3) - \delta}{2}\right] = -\frac{\delta(3-q)}{6}.$$

expected hardship in the second period. It follows from these equations that

$$\tilde{s}_1|_{\theta=0} - s_1|_{\theta=0} = \frac{\delta q(3-q)}{3(3+q)}, \quad \frac{\partial(\tilde{s}_1 - s_1)}{\partial\theta} < 0.$$

Hence, the higher the probability of an adverse shock to second-period income, and the larger the magnitude of the shock, the greater will be the gap between the savings rates with and without borrowing constraints. In addition, greater habit formation (as measured by a higher θ) reduces the gap between the two saving rates.

For the issue at hand, and as noted earlier, the shock to second-period income can be interpreted as a terms-of-trade shock. What the model predicts, therefore, is that as inferred by the Harberger-Laursen-Meltzer consumption smoothing framework, positive (negative) transitory income shocks are entirely saved (dissaved). In addition, however, a fraction of permanent income should also be set aside during "good" times. Thus, the possibility of binding borrowing constraints in "bad" states of nature implies an asymmetric response of savings to *permanent* income shocks.

It is worth noting that, in the foregoing discussion, we focused only on the case of an adverse transitory shock in the second period to simplify the analysis. If the transitory second-period shock is positive, the borrowing constraint will not bind. Hence, even if the transitory shock follows a symmetric distribution, the qualitative features of our analysis will continue to hold. We can illustrate this point with a simple example where the transitory shock follow a symmetric distribution. Suppose that the second-period transitory shock is δ with a probability equal to one-half, and $-\delta$ with a probability one-half; suppose also that there is no habit formation ($\tau = 0$). All the other assumptions continue to hold. It is easy to verify that in these conditions

$$s_1|_{\theta=0} = 0, \quad \tilde{s}_1|_{\theta=0} = \frac{\delta}{7}.$$

Hence, first-period saving is zero in the absence of borrowing constraints, whereas it is positive in the presence of these constraints (in fact, proportional to the standard deviation of the transitory shock).

Finally, we show in Appendix A that loss aversion magnifies the increase in saving induced by the anticipation of future binding borrowing constraints induced by terms-of-trade shocks. The intuition underlying this result is that under loss aversion (a particular form of asymmetric utility preferences), individuals exhibit a larger degree of risk aversion to adverse shocks to income.

As a result, they tend to save more in good times, increasing their consumption by less than the increase in income. Specifically, we follow the specification of this type of preferences explored by Aizenman (1998). In this setting, loss-averse agents tend to treat the future asymmetrically, assigning a greater probability weight to bad states of nature (compared to the probability weights that they would assign in the conventional case) in measuring expected utility. As a result, saving responds asymmetrically under loss aversion, in contrast to the conventional expected utility framework.

3 Econometric Methodology

The econometric approach used in this paper to assess the extent to which terms-of-trade shocks affect asymmetrically private savings dwells on time-series, cross-country regression techniques. A key step in the estimation is to distinguish between the transitory and permanent components of the terms of trade. The permanent component of the terms of trade is measured by the trend series obtained with three different filters: the standard Hodrick-Prescott (HP) filter, an "optimal" version of the HP filter, and a nonparametric method. In each case, the filtered series is used to capture the transitory component of terms-of-trade shocks.

The filtering techniques used here can be briefly presented as follows. Consider a seasonally-adjusted variable x_t that can be written as the sum of an unobserved trend component, x_t^*, and a residual cyclical component, x_t^c:

$$x_t = x_t^* + x_t^c. \tag{12}$$

The standard HP filter (see Hodrick and Prescott (1997)) employs an adjustment rule whereby the trend component moves continuously and adjusts gradually. Formally, the unobserved trend component x_t^* is extracted by solving the following minimization problem:

$$\underset{x_t^*}{Min} \sum_{t=1}^{T}(x_t - x_t^*)^2 + \lambda \sum_{t=2}^{T-1}[(x_{t+1}^* - x_t^*) - (x_t^* - x_{t-1}^*)]^2. \tag{13}$$

Thus, the objective is to select the trend component that minimizes the sum of the squared deviations from the observed series, subject to the constraint that changes in x_t^* vary gradually over time. The Lagrange multiplier (or smoothing parameter) λ is a positive number that penalizes changes in

the trend component. The larger the value of λ, the smoother is the resulting trend series.

The HP filter has been subject to various criticisms. In particular, it has been argued that it removes potentially valuable information from time series (King and Rebelo (1993)), and that it may impart spurious cyclical patterns to the data (Cogley and Nason (1995)). Another important limitation is the choice of the value of λ. The usual practice in the literature is to set λ to a specific value (for instance, 100 for annual time series) derived from an examination of the properties of U.S. output data by Hodrick and Prescott. However, imposing this specific value in a multi-country study can be viewed as arbitrary, and may reflect an overly stringent implicit assumption about the degree of persistence in x_t.

As a consequence, two alternative approaches are also used. The first, as discussed by Agénor, McDermott and Prasad (1998) consists in choosing a value of λ for each individual series, using a data-dependent method. Specifically, a method of *generalized cross-validation* is used. The basic principle of cross-validation is to leave the data points out one at a time and to choose the value of the smoothing parameter under which the missing data points are best predicted by the remainder of the data. A priori assumptions about the appropriate value of the smoothing parameter are not required and the smoothing parameter does not have to be held constant across all countries.

Another approach, also discussed by Agénor, McDermott and Prasad (1998), is to use a nonparametric method. This technique uses a univariate nonparametric regression estimation technique to estimate the trend and cyclical components of a series without having to specify the functional form of the trend component of the underlying series or the degree of smoothing applied to the actual data. Specifically, it permits the modeling of trends that involve higher-order polynomials without imposing a particular functional form on the trend component.[5]

The specification of the regression model uses private saving (calculated as the difference between gross domestic saving and government saving) in proportion to GDP as the dependent variable. Despite the relatively limited number of degrees of freedom available (as discussed below), the list of explanatory variables involves a fairly large group of control variables that have

[5]The method can also be extended to control for discontinuities or isolated change points in the series that may be interpreted, for instance, as level shifts in the underlying series.

been found to matter in recent studies of the determinants of saving in developing countries.[6] A brief description of the variables used in the regressions is as follows (see Appendix B for more detailed definitions):

- The lagged dependent variable, which aims to capture habit formation effects (Alessie and Lusardi (1997)) or more generally partial adjustment of the desired propensity to save to its actual value.[7]

- The permanent component of the log of the terms of trade, weighted or not by the ratio of real exports to real GDP, calculated using the three different filters described above. A weighted measure is used to capture the fact that the higher the share of exports in output, the higher the impact of fluctuations in the terms of trade. This is expected to have a negative effect on saving.

- The transitory component of the log of the terms of trade, weighted or not by the ratio of real exports to real GDP, which is expected to have also a positive effect on saving.

- An index of volatility of the terms of trade (defined as the standard deviation of the log-difference of the terms of trade over the current period and two or three lagged periods), which may represent a proxy for income uncertainty. This is expected to have a negative effect on saving.

- The log of real gross national product (GNP) per capita, which captures the impact of the level of income (and indirectly subsistence considerations) on consumption and saving decisions, or more generally the level of development. This is expected to have a positive effect on private saving.

- The growth rate of real GNP per capita, which captures improvements in standards of living. This is expected to have also a positive effect on private saving.

[6] See Agénor and Montiel (1999, Chapter 3) and Agénor (2000, Chapter 1) for a detailed review of the recent evidence on the determinants of savings in developing countries.

[7] Loayza, Schmidt-Hebbel, and Servén (1999) also attempt to distinguish between short- and long-term determinants of saving rates—a distinction that appeared highly significant in their empirical results.

- Inflation (as measured by the rate of change of the GDP deflator), which exerts a negative impact on the rate of return on saving (with sluggish nominal interest rates) and represents proxy for income variability and macroeconomic instability, it may capture a precautionary motive for the private sector. Through both channels inflation is expected to reduce the propensity to save.[8]

- The ratio of broad money to GDP, which is used to capture the process of financial liberalization. The variable may have either a positive or negative effect on private savings, depending on whether financial liberalization increases the rate of return on, say, bank deposits (thereby increasing financial savings), or on the contrary takes the form of a relaxation of domestic liquidity constraints (which would tend to increase consumption and thus reduce savings).

- Foreign saving, as given by the current account surplus. This variable is expected to have a negative effect on the propensity to save.

- The age dependency ratio, defined as the ratio of the population younger than 15 years and older than 64 years old to the population between 15 and 64 years old. This variable is also expected to have a negative effect on the incentives to save.

- Government saving, as given by the fiscal surplus. As predicted by the Ricardian Equivalence proposition (see, for instance, Seater (1993)), if agents fully internalize the effects of current budget deficits on future tax liabilities (and thus on future consumption), government saving should have a coefficient of minus unity in a regression where the dependent variable is the private savings rate.

In addition to these variables, a dummy variable is added to capture the existence of an asymmetric effect of terms of trade on saving. Specifically, the variable used is an interactive dummy defined in two different ways. In the first, the dummy takes the value of 1 times the logarithm of the permanent component of the terms of trade (weighted or not by the ratio of exports

[8]Note that real interest rates are omitted from the regression model in light of the results obtained by Ogaki, Ostry and Reinhart (1996) and Elbadawi and Mwenga (1999), which suggest a limited impact of this variable in the countries considered here, given their low levels of income (see also Appendix A).

to output, as indicated earlier) when that component increases above its previous value, and zero otherwise. In the second, the dummy takes the value of 1 times the logarithm of the permanent component of the terms of trade when that variable increases above its within-sample mean value by at least one standard deviation, and zero otherwise. A detailed explanation of the construction of these dummy variables is provided in Appendix B.

The estimation method used is instrumental variables with fixed effects to correct for possible endogeneity of some of the regressors with respect to movements in the terms of trade—namely, foreign saving, government saving, the growth rate of per capita real GDP, and inflation. For instance, movements in the terms of trade may have a substantial indirect impact on the rate of economic growth, as a result of their impact on the relative price of nontraded goods, the relative price of capital goods, and thus investment. In the first stage of the estimation procedure, all the above variables were regressed on the log of the terms of trade (weighted or not by the ratio of exports to output), the index of terms-of-trade volatility, the log of per capita real GNP, and the rate of change in the ratio of broad money to GDP. In the second stage, the residuals from the first-stage regressions were used as instruments, rather than the actual series themselves. Finally, fixed effects are aimed at capturing differences across countries by introducing differences in the constant terms of the regressions. In standard fashion (see, for instance, Greene (1997)) they are computed by subtracting the within-sample mean from each variable and performing the estimation using the transformed data.

4 Evidence for sub-Saharan Africa

The regression framework described in the previous section was estimated for the group of non-oil sub-Saharan African countries using time-series, cross-country data covering the period 1980-96; because data were not available for all the countries in the sample for the whole period, an unbalanced panel data set is used.

The regression results obtained for each of the filtering techniques described above, using two measures of the terms of trade (weighted and unweighted) are summarized in Tables 1 to 12. Each table presents a series of regressions with various sets of explanatory variables.[9] Tables 1 to 6 use the

[9]The age dependency ratio turned out to have systematically the wrong sign in most

dummy variable for asymmetric shocks defined as one times the permanent component of the terms of trade if there is a positive increase in that component between two years and zero otherwise; Tables 7 to 12 define the dummy variable as one times the permanent component of the terms of trade if there is a positive increase in that variable above the mean by at least one within-sample standard deviation and zero otherwise. In addition, Tables 1 to 3 use an unweighted terms-of-trade index and use the three alternative methods (standard HP, optimal HP, and nonparametric techniques) to calculate the permanent and transitory components of the terms of trade, whereas Tables 4 to 6 use a weighted index of the terms of trade, with weights given by the ratio of exports over output for each country. Similarly, Tables 7 to 9 (respectively 10 to 12) deal with unweighted (respectively weighted) data on the terms of trade.

Consider first Tables 1 to 6. Overall, the adjusted R-squared is quite high, indicating that the regression model explains fairly well movements in the private savings rate across countries and over time. The lagged dependent variable is highly significant, indicating (as noted earlier) either gradual adjustment to the desired level of saving or persistence effects associated with habit formation. Per capita income is also significant and positive (as expected), whereas the growth rate of output, while having the correct sign, does not appear to have a discernible effect on private savings. The coefficient of the inflation rate is not well determined (its sign changes across regressions) and is never significant. This may reflect the importance of low-inflation, CFA Franc countries in the sample. Foreign savings has a significant and negative impact on private savings, although the results appear to be weaker when the nonparametric filter and unweighted terms of trade are used. Government savings has a highly significant negative effect on private savings, as found in many recent studies on developing countries; government dissavings and their future tax implications tend to be internalized by private agents. The *short-term* coefficient of that variable is around 0.6; the coefficient of the lagged variable is about 0.5, which gives a *long-term* coefficient of 1.2 that is not significantly different from unity. This suggests that Ricardian Equivalence does hold in the long run, in contrast to the results found by some recent studies. The index of financial development (the ratio of the broad money stock to GDP) has a highly significant and negative effect

regressions and often tended not to be significant. It was thus omitted from the results reported here.

on private savings; as noted earlier, this result is consistent with the view that financial liberalization may be accompanied by a relaxation of domestic liquidity constraints (increased access to bank credit, for instance), which may stimulate consumption and reduce the propensity to save.

The index of volatility of the terms of trade measured by the standard deviation of the actual itself performs poorly in most regressions regardless of whether three or four lagged values are used. The index based on the transitory component of the terms of trade only does not perform much better, except when the standard HP filter and weighted terms of trade are used (regressions (9) to (12), Table 4). In these regressions, volatility has a positive effect on saving, as found for instance by Ghosh and Ostry (1994). As predicted by the consumption-smoothing view, the permanent component of the terms of trade is nowhere significant. By contrast, the transitory (cyclical) component is everywhere significant and has the right sign, also as predicted by consumption smoothing considerations. However, the short-term coefficient of that variable is around 0.1 whereas the long-term value is around 0.2; both of these values are significantly different from unity, suggesting that the "pass-through" is less than complete—perhaps because households are unable (even in the long run) to assess fully the degree of persistence of terms-of-trade shocks at the moment they occur. The dummy variable that captures the asymmetric effect of terms-of-trade shocks is significant at a 1 percent level when the standard HP filter is used, with both weighted and unweighted measures of the terms of trade. By contrast, with the optimal HP filter, the variable is not significant with unweighted terms of trade and is significant at only a 10 percent level when weighted terms of trade are used. With the nonparametric filter, the variable is also significant at a 10 percent level and has the correct sign, regardless of whether the terms of trade are weighted or not.

Consider now Tables 7 to 12, in which regressions are based on the second measure of asymmetric shocks discussed earlier. The sign of the control variables are very similar to those obtained previously and to save space interpretations are not repeated here. Regarding the terms of trade variables, similar results also emerge: the index of volatility has a discernible effect on private savings only when the standard HP filter and the weighted terms of trade are used, and the coefficient of the permanent component of the terms of trade is not significantly different from zero. The dummy variable capturing the asymmetric impact of improvements in the permanent component of the terms of trade is highly significant when the HP filter is used,

with both weighted and unweighted measures. That is also the case with the optimal HP filter—albeit significance levels are lower with weighted terms of trade. With the nonparametric filter, the dummy variable is significant (at a 5 percent level) with unweighted terms of trade and not significant (although with the correct sign) when the terms of trade weighted by the share of exports in output are used. Thus, the overall conclusion from the regression results presented here is that favorable movements in the permanent component of the terms of trade tend to have the asymmetric effect hypothesized earlier on private savings. The use of a series of control variables, weighted and unweighted terms of trade, three different detrending techniques, and two different ways of measuring "favorable" disturbances give some degree of robustness to the results.

5 Concluding Remarks

The purpose of this paper has been to examine whether terms-of-trade shocks have an asymmetric effect on private savings. The first part used a simple three-period framework to argue that, in the presence of binding borrowing constraints in bad states of nature, savings rates can be sensitive to favorable movements in the permanent component of the terms of trade—in contrast to what the conventional consumption-smoothing framework would predict. Households in developing countries (particularly those that have limited creditworthiness to begin with) may indeed be unable to smooth consumption in the face of adverse shocks to world commodity prices and the terms of trade, because they are subject to credit constraints that become more binding in such situations. As a result, to maintain a smooth consumption path, domestic agents may be forced to dissave by a larger amount than they would otherwise when faced with a significant deterioration in their terms of trade. This argument also suggests that, to the extent that domestic agents internalize the possibility of facing tighter credit constraints in bad states of nature, they may also consume less and save more in good times.

The second part described the econometric methodology and the empirical specification of the model, which controls for various standard determinants of private savings. The third part presented and discussed the regression results, based on panel data for non-oil commodity exporters of sub-Saharan Africa covering the period 1980-96. Overall, they suggest that transitory movements in the terms of trade have a positive effect (albeit less

than one to one) on the propensity to save and that increases in the permanent component of the terms of trade (measured using three alternative detrending techniques and with both weighted and unweighted measures of the terms of trade) tend indeed to lead to higher rates of private savings.

Our interpretation focused on the adjustment of saving to a permanent shock, in circumstances where borrowing constraints are anticipated to bind in the future. It should be noted, however, that the empirical results may be consistent with another interpretation. For example, if the permanent shock is associated with an anticipated increase in future volatility, it would raise the demand for assets needed to be used as an effective buffer stock in the future, increasing thereby saving today. Nevertheless, it can be verified that the logic of our analysis continues to apply in this case—the increase in the demand for the buffer stock is magnified by the anticipation of future borrowing credit constraints and by greater loss aversion.

The analysis developed in this paper can be extended to study the asymmetric effects of terms-of-trade shocks on saving to *oil-exporting* countries and analyze the response of *public* savings as well.[10] This is important because of the policy concerns that the high degree of commodity price volatility has generated in recent years. The 1998 slump in commodity prices, for instance, generated large terms-of-trade effects. Although the real income effect on primary commodity exporters was moderate (of the order of -0.5 percent of GDP), and net importers of oil and primary commodities actually registered a gain overall, oil exporters registered a negative real income effect of the order of -6.3 percent of GDP (World Bank (2000, Chapter 4)). Because oil exports account for almost all of government revenues in oil-exporting countries, the public sector bore the brunt of adjustment. The ability of each country to smooth public consumption in response to the revenue shortfall was, however, limited by their ability to draw down their official reserves and to borrow, both domestically and abroad. In many cases, constraints on domestic finance and lack of access to international capital markets actually prevented governments from successfully smoothing the impact of the oil price cycle, and economic performance deteriorated.[11] The same study by

[10]An early study that attempted to test for an asymmetric effect of terms-of-trade movements on savings in oil-exporting countries is by Spatafora and Warner (1995). However, the test poerformed by the authors was essentially a standard stability test of the coefficient of the terms-of-trade variable across two sub-periods (1965-80 and 1981-89).

[11]The World Bank report estimated that the effect of the drop in oil prices on the external earnings of oil-exporting countries in sub-Saharan Africa led to a deterioration in

the World Bank also noted that although adjustment to the oil price swings in the past few years differed significantly across oil exporters, most countries increased their aggregate saving rates during the rise in oil prices in 1996-97 (compared to 1993-95) and reduced them during the 1998 slump. This pattern is consistent with consumption smoothing behavior in the presence of perceived transitory shocks. In addition, the savings response was found to be asymmetric: on average, savings rates rose by less than half of the real income gain during the 1996-97 boom, but fell by the full amount of the decline in real incomes during the 1998 collapse in prices. Extending the analytical framework presented in this paper to account for an asymmetric response of public savings along these lines would provide a fruitful exercise.

the fiscal balance of these countries of about 7 percent of GDP in 1998.

Appendix A
Loss Aversion, Savings, and Borrowing Constraints

The purpose of this Appendix is to show that, following Aizenman (1998), loss aversion magnifies the increase in saving induced by the anticipation of future binding borrowing constraints induced by adverse shocks to income.

For expositional simplicity, we will assume the absence of habit formation, that is, the case in which $\tau = \theta = 0$ in equation (2). Loss aversion modifies the maximization problem with full access to the capital market given in (4) as follows:

$$\max_{s_1, s_2^L, s_2^H} \begin{cases} u(x - s_1) + (\omega + q)[u(x - \delta + s_1 - s_2^L) + u(x + s_2^L)] \\ +(1 - q - \omega)[u(x + s_1 - s_2^H) + u(x + s_2^H)] \end{cases}, \tag{A1}$$

where to simplify notations, $u(c_{t-1}; c_t)$ is written as $u(c_t)$ and $1 - q \geq \omega \geq 0$. The term ω is the extra utility weight attached to the bad state of nature due to loss aversion (see Aizenman (1998) for further details). The expected utility case corresponds to $\omega = 0$. With no access to the capital market, the maximization problem (9) becomes

$$\max_{s_1, s_2^H} \begin{cases} u(x - s_1) + (\omega + q)[u(x - \delta + s_1) + u(x)] \\ (1 - q - \omega)[u(x + s_1 - s_2^H) + u(x + s_2^H)] \end{cases}. \tag{A2}$$

Applying (A1) if follows that with access to the world capital market, first-period saving is

$$s_1 = \frac{\delta(q + \omega)}{3}, \tag{A3}$$

whereas without access to borrowing and with no habit formation, saving is

$$\tilde{s}_1 = \frac{\delta(q + \omega)}{2 - 0.5[1 - (q + \omega)]}. \tag{A4}$$

From (A3) and (A4), we have

$$\tilde{s}_1 - s_1 = \frac{\delta(q + \omega)(3 - q - \omega)}{3(3 + q + \omega)}.$$

Consequently, loss aversion magnifies the increase in saving associated with future borrowing constraints.

Appendix B
Countries, Variables, and Data Sources

This Appendix presents the list of countries included in the text and provides a more precise definition of the variables used in the regressions (including the dummy variables) shown in Tables 1 to 12.

The sample used in this study includes all sub-Saharan African countries except oil exporters. Specifically, the list of the countries consists of Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Democratic Congo, Cote d'Ivoire, Djibouti, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mayotte, Mozambique, Namibia, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leona, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

The variables used in the regressions reported in Tables 1 to 12 are defined as follows.

- Private saving, $SP\%GDP$: The ratio of private saving to GDP. It is obtained as the difference between Gross Domestic Saving and Government Saving. The gross domestic saving is defined as the difference between gross domestic product and total consumption. Source: the World Bank's Statistical Information Management and Analysis System (SIMA).

- Foreign saving, $SF\%GDP$: Ratio of foreign saving to GDP. Foreign saving is equal to the current account surplus, which is defined as minus the sum of net exports of goods and services, income and current transfers. Source: SIMA.

- Residual foreign saving, $RSF\%GDP$: obtained by regressing foreign saving on the log of the terms of trade weighted by the ratio of real exports to real GDP, an index of terms-of-trade volatility, the log of real GNP per capita, and the rate of change in the ratio of broad money to GDP.

- Inflation, $INFL$: growth rate of GDP Deflator. It is calculated by using GDP in current and constant 1987 local currency prices. Source: *World Development Indicators* (WDI).

- Residual inflation, *RINFL*: Obtained by regressing inflation on the log of the terms of trade weighted by the ratio of real exports to real GDP, an index of terms-of-trade volatility, the log of real GNP per capita, and the rate of change in the ratio of broad money to GDP.

- Log of real GNP per capita, *LGNPPC*: gross national product (in constant 1995 U.S. dollars) divided by midyear population. Source: WDI.

- Real GNP per capita growth rate, *GNPGR*: growth rate of real GNP per capita. Source: WDI.

- Residual Real GNP per capita Growth Rate, *RGNPGR*: obtained by regressing real GNP per capita on the log of the terms of trade weighted by the ratio of real exports to real GDP, an index of terms-of-trade volatility (as defined above), the log of real GNP per capita, and the rate of change in the ratio of broad money to GDP.

- Government Saving, *SG%GDP*: ratio of government saving to GDP. Government saving is defined as the difference between tax revenue and general government consumption. General government consumption includes all current expenditures for purchases of goods and services by all levels of government, excluding most government enterprises. It also includes capital expenditure on national defense and security. Tax revenue comprises compulsory, unrequited, nonrepayable receipts for public purposes collected by central governments. Source: SIMA.

- Residual government saving, *RSG%GDP*: obtained by regressing government saving on the logarithm (log) of the terms of trade weighted by the ratio of real exports to real GDP, an index of volatility of the terms of trade (as defined below), the log of real GNP per capita, and the rate of change in the ratio of broad money to GDP.

- Trend component of terms of trade weighted by ratio of real exports to real GDP, *RLTOT*: obtained through the three filtering methods described in the text. The terms of trade used in this study are defined as the log of the terms of trade unweighted and weighted by the ratio of real exports of goods and services to real GDP. The terms of trade for goods and services are the ratio of the export price index to the corresponding import price index (with base 1995=100). Real exports of

goods and services and real GDP are defined in constant local currency units. Source: SIMA.

- Residual (temporary) component of terms of trade weighted by ratio of real exports to real GDP, $RLTOT$: The residual component of the terms of trade is calculated as the difference between the (weighted or unweighted) terms of trade and $LTOT$.

- Index of terms-of-trade volatility, $VLTOT3$: equal to the standard deviation of the log-difference of the terms of trade for periods t, $t-1$ and $t-2$.

- Index of terms-of-trade volatility, $VLTOT4$: equal to the standard deviation of the log-difference of the terms of trade for periods t, $t-1$, $t-2$ and $t-3$.

- Index of terms-of-trade volatility, $VR3$: equal to the standard deviation of the log-difference of the residual component of weighted terms of trade for periods t, $t-1$ and $t-2$, using each alternative filter.

- Index of terms-of-trade volatility, $VR4$: equal to the standard deviation of the log-difference of the residual component of weighted terms of trade for periods t, $t-1$, $t-2$ and $t-3$, using each filter alternative filter.

- $DUMMY$: dummy variable equal to 1 times $LTOT$ for period t whenever $LTOT_t$ is greater than $LTOT_{t-1}$ and 0 otherwise.

- $DUMMY2$: dummy variable equal to 1 times $LTOT$ for period t whenever $LTOT_t$ is greater than the mean value of $LTOT$ plus at least one standard deviation of $LTOT$, and 0 otherwise.

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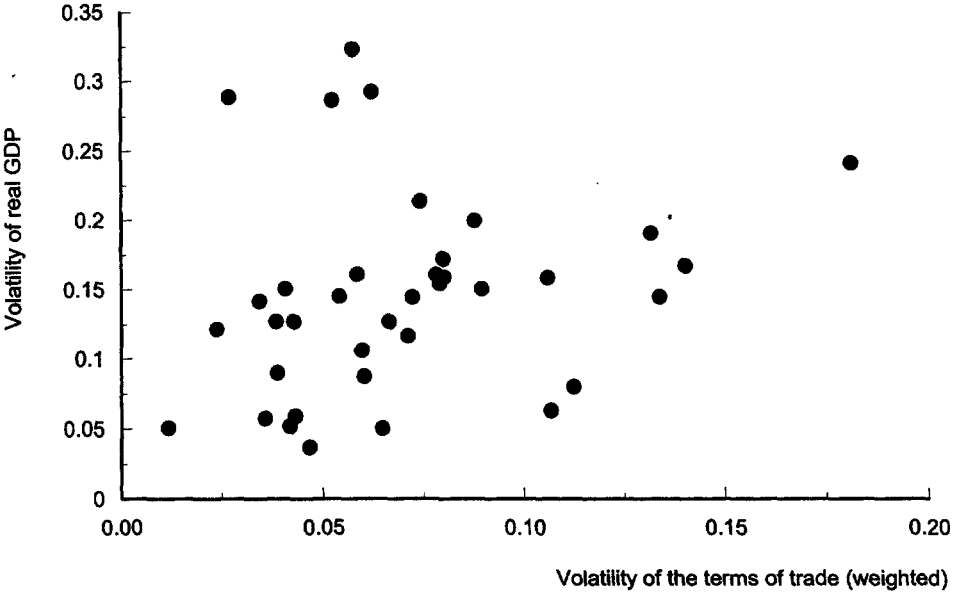
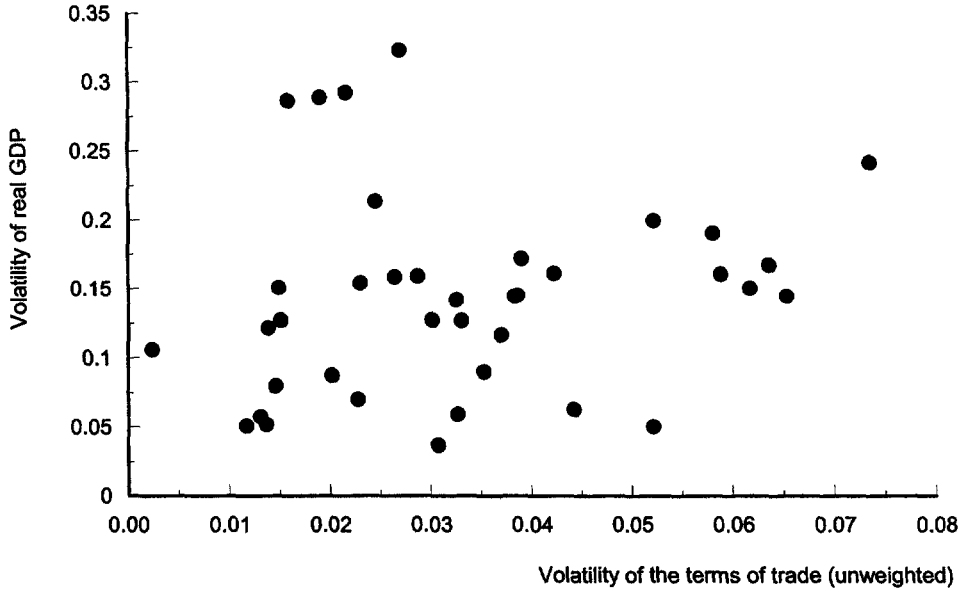
Figure 1
Non-Oil Sub-Saharan Africa:
Volatility of Output and the Terms of Trade 1/
(Averages for 1980-96)





Source: World Bank.

Note: Volatility is measured by the coefficient of variation over the whole sample period.
1/ List of the countries: Benin, Bostwana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo Democratic Republic, Ethopia, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Table 1
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Unweighted terms of trade, HP filter)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SP%GDP(-1)	0.495	0.490	0.495	0.493	0.490	0.489	0.474	0.469	0.474	0.473	0.469	0.468
	(9.122)	(8.916)	(9.125)	(9.107)	(8.924)	(8.905)	(8.852)	(8.613)	(8.852)	(8.824)	(8.621)	(8.594)
RSF%GDP	-0.135	-0.141	-0.135	-0.134	-0.142	-0.142	-0.109	-0.113	-0.109	-0.110	-0.114	-0.116
	(-2.140)	(-2.204)	(-2.140)	(-2.154)	(-2.217)	(-2.257)	(-1.754)	(-1.781)	(-1.754)	(-1.790)	(-1.794)	(-1.856)
RINFL	-0.025	-0.023	-0.025		-0.022		-0.022	-0.020	-0.022		-0.019	
	(-0.461)	(-0.411)	(-0.460)		(-0.401)		(-0.406)	(-0.367)	(-0.407)		(-0.358)	
LGNPPC	0.061	0.077	0.060	0.075	0.076	0.091	0.083	0.097	0.083	0.098	0.095	0.112
	(1.746)	(2.134)	(1.740)	(2.264)	(2.106)	(2.653)	(2.382)	(2.675)	(2.379)	(2.938)	(2.643)	(3.225)
RGNPGR	0.084	0.088	0.084		0.086		0.097	0.100	0.098		0.099	
	(1.214)	(1.265)	(1.218)		(1.235)		(1.436)	(1.466)	(1.443)		(1.437)	
RSG%GDP	-0.576	-0.583	-0.576	-0.565	-0.587	-0.576	-0.610	-0.611	-0.609	-0.595	-0.615	-0.601
	(-6.630)	(-6.656)	(-6.604)	(-6.561)	(-6.697)	(-6.658)	(-7.110)	(-7.059)	(-7.077)	(-6.996)	(-7.098)	(-7.025)
M2%GDP	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.002	-0.003	-0.002	-0.002	-0.003	-0.003
	(-3.234)	(-3.584)	(-3.240)	(-3.392)	(-3.554)	(-3.682)	(-3.555)	(-3.808)	(-3.566)	(-3.714)	(-3.779)	(-3.901)
LTOT	0.041	0.034	0.042	0.039	0.033	0.028	0.031	0.024	0.032	0.028	0.023	0.017
	(0.880)	(0.742)	(0.893)	(0.836)	(0.695)	(0.593)	(0.674)	(0.532)	(0.696)	(0.617)	(0.495)	(0.369)
RLTOT	0.089	0.097	0.090	0.096	0.095	0.102	0.077	0.084	0.078	0.086	0.082	0.091
	(2.790)	(2.993)	(2.824)	(3.079)	(2.960)	(3.236)	(2.453)	(2.615)	(2.495)	(2.795)	(2.580)	(2.898)
VLTOT3	0.047						0.047					
	(0.678)						(0.693)					
VLTOT4		0.115						0.121				
		(1.488)						(1.596)				
VR3			0.029	0.039					0.026	0.036		
			(0.386)	(0.547)					(0.366)	(0.517)		
VR4					0.106	0.128					0.110	0.133
					(1.192)	(1.480)					(1.258)	(1.561)
DUMMY							0.007	0.006	0.007	0.007	0.006	0.006
							(3.280)	(3.070)	(3.280)	(3.194)	(3.066)	(2.983)
Adj. R2	0.930	0.930	0.930	0.930	0.930	0.930	0.933	0.933	0.933	0.932	0.933	0.932
Total panel Observations	283	279	283	283	279	279	283	279	283	283	279	279
Standard error of regression	0.056	0.056	0.056	0.056	0.056	0.056	0.055	0.055	0.055	0.055	0.055	0.055

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade, obtained by Hodrick-Prescott filter method. RLTOT is the residual component of terms of trade, obtained by Hodrick-Prescott filter method. VLTOT3 is the volatility measure as the standard deviation of terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than $LTOT_{t-1}$.

Table 2
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Unweighted terms of trade, Optimum lambda filter)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SP%GDP(-1)	0.526	0.521	0.526	0.528	0.521	0.522	0.526	0.520	0.526	0.528	0.520	0.521
	(8.622)	(8.471)	(8.625)	(8.742)	(8.445)	(8.563)	(8.574)	(8.403)	(8.579)	(8.700)	(8.369)	(8.498)
RSF%GDP	-0.124	-0.123	-0.121	-0.111	-0.120	-0.110	-0.124	-0.125	-0.121	-0.111	-0.123	-0.113
	(-1.738)	(-1.722)	(-1.687)	(-1.572)	(-1.680)	(-1.567)	(-1.730)	(-1.733)	(-1.677)	(-1.565)	(-1.694)	(-1.584)
RINFL	-0.054	-0.053	-0.057		-0.056		-0.054	-0.054	-0.057		-0.057	
	(-0.827)	(-0.822)	(-0.874)		(-0.862)		(-0.827)	(-0.833)	(-0.873)		(-0.873)	
LGNPPC	0.134	0.141	0.131	0.144	0.140	0.154	0.134	0.140	0.131	0.144	0.139	0.152
	(3.090)	(3.216)	(3.036)	(3.534)	(3.180)	(3.714)	(3.056)	(3.167)	(3.004)	(3.485)	(3.134)	(3.640)
RGNPGR	0.045	0.048	0.039		0.040		0.044	0.047	0.038		0.038	
	(0.536)	(0.584)	(0.476)		(0.496)		(0.528)	(0.557)	(0.470)		(0.469)	
RSG%GDP	-0.611	-0.603	-0.609	-0.614	-0.605	-0.610	-0.612	-0.604	-0.609	-0.614	-0.606	-0.611
	(-6.227)	(-6.118)	(-6.214)	(-6.318)	(-6.152)	(-6.255)	(-6.207)	(-6.107)	(-6.192)	(-6.294)	(-6.142)	(-6.245)
M2%GDP	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(-4.254)	(-4.262)	(-4.271)	(-4.454)	(-4.279)	(-4.467)	(-4.180)	(-4.220)	(-4.195)	(-4.381)	(-4.241)	(-4.433)
LTOT	0.000	-0.004	0.003	0.008	-0.004	-0.000	0.001	-0.002	0.004	0.009	-0.002	0.001
	(0.015)	(-0.079)	(0.069)	(0.159)	(-0.075)	(-0.001)	(0.022)	(-0.050)	(0.074)	(0.165)	(-0.047)	(0.035)
RLTOT	0.100	0.098	0.106	0.108	0.100	0.102	0.100	0.098	0.106	0.108	0.100	0.101
	(3.089)	(3.027)	(3.245)	(3.489)	(3.068)	(3.280)	(3.080)	(3.020)	(3.233)	(3.471)	(3.054)	(3.252)
VLTOT3	0.007						0.008					
	(0.087)						(0.097)					
VLTOT4		0.092						0.095				
		(1.045)						(1.065)				
VR3			0.004	0.015					0.005	0.016		
			(0.050)	(0.182)					(0.058)	(0.189)		
VR4					0.100	0.115					0.105	0.119
					(0.990)	(1.141)					(1.017)	(1.168)
DUMMY							-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
							(-0.062)	(-0.237)	(-0.045)	(-0.056)	(-0.250)	(-0.268)
Adj. R2	0.935	0.934	0.935	0.935	0.934	0.935	0.934	0.934	0.934	0.934	0.934	0.934
Total panel Observations	224	224	224	224	224	224	224	224	224	224	224	224
Standard error of regression	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (*SF%GDP is the ratio of foreign savings to GDP*; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade, obtained by optimum lambda filtering method. RLTOT is the residual component of terms of trade, obtained by optimum lambda filtering method. VLTOT3 is the volatility measure as the standard deviation of terms of trade for periods *t*-2, *t*-1 and *t*, and VLTOT4 is for the period *t*-3, *t*-2, *t*-1 and *t*. VR3 and VR4 are the volatility measures of RLTOT for the period of *t*-2, *t*-1 and *t*, and *t*-3, *t*-2, *t*-1 and *t*, *successively*. DUMMY is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than $LTOT_{t-1}$.

Table 3
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Unweighted terms of trade, Non-parametric filter)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SP%GDP(-1)	0.533	0.528	0.532	0.532	0.530	0.530	0.503	0.501	0.502	0.504	0.502	0.503
	(8.656)	(8.507)	(8.647)	(8.786)	(8.569)	(8.687)	(7.975)	(7.874)	(7.955)	(8.074)	(7.910)	(8.008)
RSF%GDP	-0.123	-0.122	-0.120	-0.113	-0.119	-0.112	-0.120	-0.119	-0.118	-0.110	-0.116	-0.110
	(-1.719)	(-1.704)	(-1.676)	(-1.613)	(-1.654)	(-1.600)	(-1.696)	(-1.677)	(-1.651)	(-1.586)	(-1.624)	(-1.570)
RINFL	-0.033	-0.031	-0.036		-0.033		-0.033	-0.031	-0.037		-0.034	
	(-0.521)	(-0.505)	(-0.578)		(-0.533)		(-0.537)	(-0.508)	(-0.596)		(-0.544)	
LGNPPC	0.130	0.137	0.128	0.140	0.132	0.146	0.128	0.135	0.127	0.141	0.131	0.146
	(3.030)	(3.152)	(3.013)	(3.508)	(3.087)	(3.622)	(3.014)	(3.133)	(3.010)	(3.543)	(3.084)	(3.661)
RGNPGR	0.054	0.059	0.046		0.052		0.063	0.069	0.055		0.061	
	(0.666)	(0.727)	(0.576)		(0.648)		(0.776)	(0.851)	(0.686)		(0.768)	
RSG%GDP	-0.623	-0.615	-0.620	-0.625	-0.619	-0.622	-0.639	-0.630	-0.636	-0.640	-0.633	-0.636
	(-6.265)	(-6.157)	(-6.256)	(-6.383)	(-6.215)	(-6.329)	(-6.444)	(-6.321)	(-6.427)	(-6.545)	(-6.377)	(-6.480)
M2%GDP	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(-4.292)	(-4.300)	(-4.349)	(-4.541)	(-4.318)	(-4.512)	(-4.398)	(-4.394)	(-4.462)	(-4.664)	(-4.421)	(-4.626)
LTOT	0.009	0.005	0.012	0.008	0.008	0.003	0.011	0.007	0.014	0.009	0.010	0.004
	(0.180)	(0.100)	(0.245)	(0.170)	(0.165)	(0.077)	(0.226)	(0.140)	(0.289)	(0.201)	(0.203)	(0.099)
RLTOT	0.112	0.109	0.120	0.127	0.114	0.121	0.101	0.098	0.109	0.117	0.103	0.112
	(2.952)	(2.886)	(3.127)	(3.452)	(2.972)	(3.284)	(2.642)	(2.571)	(2.833)	(3.188)	(2.673)	(3.019)
VLTOT3	0.009						-0.003					
	(0.113)						(-0.044)					
VLTOT4		0.095						0.086				
		(1.075)						(0.978)				
VR3			-0.007	-0.001					-0.017	-0.010		
			(-0.094)	(-0.013)					(-0.212)	(-0.131)		
VR4					0.072	0.085					0.067	0.080
					(0.763)	(0.903)					(0.711)	(0.861)
DUMMY							0.004	0.004	0.004	0.004	0.004	0.004
							(1.850)	(1.750)	(1.841)	(1.789)	(1.768)	(1.707)
Adj. R2	0.935	0.934	0.935	0.935	0.934	0.935	0.935	0.935	0.935	0.936	0.935	0.935
Total panel Observations	224	224	224	224	224	224	224	224	224	224	224	224
Standard error of regression	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade, obtained by non-parametric filtering method. RLTOT is the residual component of terms of trade, obtained by non-parametric filtering method. VLTOT3 is the volatility measure as the standard deviation of terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than $LTOT_{t-1}$.

Table 4
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Weighted terms of trade, HP filter)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SP%GDP(-1)	0.459	0.454	0.458	0.461	0.453	0.456	0.451	0.446	0.451	0.449	0.445	0.444
	(8.591)	(8.361)	(8.545)	(8.583)	(8.283)	(8.372)	(8.511)	(8.277)	(8.472)	(8.441)	(8.202)	(8.178)
RSF%GDP	-0.127	-0.135	-0.127	-0.135	-0.133	-0.145	-0.127	-0.133	-0.127	-0.128	-0.132	-0.134
	(-2.066)	(-2.163)	(-2.070)	(-2.213)	(-2.147)	(-2.360)	(-2.089)	(-2.147)	(-2.091)	(-2.128)	(-2.138)	(-2.192)
RINFL	-0.006	-0.002	-0.011		-0.006		-0.004	-0.003	-0.009		-0.006	
	(-0.107)	(-0.041)	(-0.191)		(-0.116)		(-0.085)	(-0.050)	(-0.165)		(-0.106)	
LGNPPC	0.080	0.086	0.078	0.102	0.085	0.113	0.094	0.099	0.092	0.104	0.098	0.111
	(2.352)	(2.470)	(2.287)	(3.101)	(2.437)	(3.321)	(2.741)	(2.812)	(2.681)	(3.231)	(2.789)	(3.342)
RGNPGR	0.080	0.090	0.082		0.092		0.073	0.084	0.074		0.085	
	(1.173)	(1.299)	(1.198)		(1.336)		(1.070)	(1.219)	(1.094)		(1.247)	
RSG%GDP	-0.586	-0.594	-0.585	-0.543	-0.593	-0.558	-0.613	-0.619	-0.612	-0.600	-0.619	-0.604
	(-6.904)	(-6.922)	(-6.882)	(-6.675)	(-6.909)	(-6.827)	(-7.214)	(-7.217)	(-7.192)	(-7.204)	(-7.207)	(-7.204)
M2%GDP	-0.002	-0.003	-0.002	-0.002	-0.003	-0.003	-0.002	-0.003	-0.002	-0.003	-0.003	-0.003
	(-3.437)	(-3.699)	(-3.391)	(-3.633)	(-3.673)	(-3.843)	(-3.675)	(-3.923)	(-3.631)	(-3.800)	(-3.903)	(-4.045)
LTOT	0.030	0.037	0.030	0.018	0.036	0.019	0.020	0.027	0.020	0.017	0.026	0.022
	(0.937)	(1.139)	(0.939)	(0.592)	(1.110)	(0.627)	(0.627)	(0.837)	(0.623)	(0.585)	(0.808)	(0.730)
RLTOT	0.110	0.107	0.108	0.117	0.106	0.116	0.107	0.103	0.105	0.108	0.102	0.107
	(4.463)	(4.347)	(4.358)	(4.911)	(4.273)	(4.886)	(4.372)	(4.232)	(4.274)	(4.594)	(4.161)	(4.527)
VLTOT3	0.063						0.070					
	(1.259)						(1.392)					
VLTOT4		0.082						0.093				
		(1.492)						(1.700)				
VR3			0.098	0.066					0.102	0.100		
			(1.654)	(0.947)					(1.740)	(1.843)		
VR4					0.117	0.138					0.126	0.121
					(1.672)	(1.671)					(1.802)	(1.820)
DUMMY							0.006	0.006	0.006	0.007	0.006	0.007
							(2.285)	(2.263)	(2.287)	(2.363)	(2.277)	(2.344)
Adj. R2	0.933	0.933	0.933	0.933	0.933	0.933	0.935	0.934	0.934	0.935	0.934	0.935
Total panel Observations	283	279	283	283	279	279	283	279	283	283	279	279
Standard error of regression	0.054	0.055	0.054	0.055	0.055	0.055	0.054	0.054	0.054	0.054	0.054	0.054

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade weighted by the ratio of real exports to real GDP, obtained by Hodrick-Prescott filter method. RLTOT is the residual component of terms of trade weighted by the ratio of real exports to real GDP, obtained by Hodrick-Prescott filter method. VLTOT3 is the volatility measure as the standard deviation of weighted terms of trade for the periods of t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than $LTOT_{t-1}$.

Table 5
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Weighted terms of trade, Optimum lambda filter)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SP%GDP(-1)	0.475	0.477	0.479	0.478	0.482	0.482	0.475	0.476	0.479	0.479	0.482	0.483
	(7.723)	(7.741)	(7.777)	(7.848)	(7.805)	(7.893)	(7.754)	(7.767)	(7.820)	(7.912)	(7.843)	(7.948)
RSF%GDP	-0.184	-0.193	-0.179	-0.177	-0.189	-0.188	-0.173	-0.182	-0.168	-0.167	-0.178	-0.177
	(-2.383)	(-2.483)	(-2.314)	(-2.314)	(-2.418)	(-2.426)	(-2.255)	(-2.352)	(-2.181)	(-2.179)	(-2.289)	(-2.291)
RINFL	-0.012	-0.011	-0.019		-0.020		-0.011	-0.011	-0.016		-0.018	
	(-0.180)	(-0.164)	(-0.276)		(-0.286)		(-0.159)	(-0.164)	(-0.241)		(-0.264)	
LGNPPC	0.191	0.189	0.188	0.196	0.184	0.190	0.193	0.189	0.190	0.195	0.185	0.189
	(4.204)	(4.172)	(4.190)	(4.702)	(4.116)	(4.600)	(4.261)	(4.208)	(4.254)	(4.699)	(4.163)	(4.582)
RGNPGR	0.024	0.013	0.025		0.018		0.010	0.000	0.011		0.004	
	(0.307)	(0.165)	(0.316)		(0.227)		(0.133)	(0.006)	(0.139)		(0.056)	
RSG%GDP	-0.621	-0.612	-0.621	-0.622	-0.615	-0.618	-0.648	-0.637	-0.649	-0.652	-0.642	-0.646
	(-6.556)	(-6.483)	(-6.528)	(-6.700)	(-6.469)	(-6.653)	(-6.771)	(-6.681)	(-6.760)	(-6.946)	(-6.685)	(-6.879)
M2%GDP	-0.005	-0.005	-0.005	-0.005	-0.004	-0.005	-0.005	-0.004	-0.004	-0.005	-0.004	-0.004
	(-4.944)	(-4.936)	(-4.908)	(-5.141)	(-4.853)	(-5.091)	(-4.896)	(-4.874)	(-4.860)	(-5.059)	(-4.793)	(-4.999)
LTOT	0.010	0.014	0.006	0.009	0.008	0.012	0.000	0.004	-0.003	-0.002	-0.001	0.002
	(0.261)	(0.346)	(0.167)	(0.264)	(0.204)	(0.328)	(0.017)	(0.108)	(-0.076)	(-0.006)	(-0.031)	(0.073)
RLTOT	0.116	0.113	0.117	0.119	0.115	0.116	0.114	0.111	0.115	0.116	0.112	0.112
	(4.761)	(4.689)	(4.809)	(5.040)	(4.731)	(4.958)	(4.673)	(4.593)	(4.744)	(4.928)	(4.652)	(4.827)
VLTOT3	0.009						0.016					
	(0.169)						(0.301)					
VLTOT4		0.010						0.021				
		(0.177)						(0.357)				
VR3			0.012	0.014					0.015	0.017		
			(0.207)	(0.253)					(0.258)	(0.316)		
VR4					0.010	0.012					0.016	0.020
					(0.154)	(0.193)					(0.249)	(0.304)
DUMMY							0.006	0.006	0.006	0.007	0.006	0.006
							(1.657)	(1.587)	(1.718)	(1.772)	(1.657)	(1.696)
Adj. R2	0.941	0.941	0.941	0.941	0.941	0.941	0.942	0.941	0.941	0.942	0.941	0.942
Total panel Observations	219	219	219	219	219	219	219	219	219	219	219	219
Standard error of regression	0.054	0.054	0.054	0.053	0.054	0.054	0.053	0.054	0.053	0.053	0.054	0.053

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade weighted by the ratio of real exports to real GDP, obtained by optimum lambda filtering method. RLTOT is the residual component of terms of trade weighted by the ratio of real exports to real GDP, obtained by optimum lambda filtering method. VLTOT3 is the volatility measure as the standard deviation of weighted terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than $LTOT_{t-1}$.

Table 6
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Weighted terms of trade, Non-parametric filter)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SP%GDP(-1)	0.479	0.479	0.483	0.479	0.486	0.482	0.471	0.472	0.476	0.473	0.478	0.476
	(7.732)	(7.742)	(7.794)	(7.810)	(7.834)	(7.859)	(7.627)	(7.638)	(7.688)	(7.734)	(7.730)	(7.785)
RSF%GDP	-0.186	-0.195	-0.182	-0.184	-0.197	-0.199	-0.189	-0.197	-0.184	-0.184	-0.198	-0.198
	(-2.392)	(-2.499)	(-2.339)	(-2.387)	(-2.515)	(-2.564)	(-2.441)	(-2.527)	(-2.370)	(-2.395)	(-2.544)	(-2.573)
RINFL	0.020	0.021	0.005		0.006		0.009	0.008	-0.006		-0.005	
	(0.308)	(0.316)	(0.079)		(0.103)		(0.147)	(0.125)	(-0.104)		(-0.078)	
LGNPPC	0.182	0.180	0.182	0.189	0.183	0.190	0.186	0.182	0.183	0.191	0.186	0.192
	(3.986)	(3.959)	(4.026)	(4.503)	(4.074)	(4.535)	(4.074)	(4.006)	(4.077)	(4.567)	(4.139)	(4.613)
RGNPGR	0.051	0.040	0.050		0.044		0.039	0.030	0.038		0.032	
	(0.658)	(0.513)	(0.659)		(0.583)		(0.506)	(0.387)	(0.501)		(0.423)	
RSG%GDP	-0.609	-0.602	-0.604	-0.596	-0.610	-0.603	-0.631	-0.621	-0.622	-0.619	-0.629	-0.627
	(-6.364)	(-6.301)	(-6.316)	(-6.417)	(-6.367)	(-6.480)	(-6.569)	(-6.472)	(-6.482)	(-6.615)	(-6.544)	(-6.688)
M2%GDP	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(-5.066)	(-5.063)	(-5.139)	(-5.315)	(-5.199)	(-5.379)	(-5.200)	(-5.157)	(-5.232)	(-5.427)	(-5.304)	(-5.503)
LTOT	0.060	0.062	0.059	0.058	0.063	0.062	0.059	0.061	0.058	0.058	0.062	0.062
	(0.350)	(0.418)	(0.328)	(0.407)	(0.453)	(0.547)	(0.327)	(0.369)	(0.280)	(0.423)	(0.406)	(0.564)
RLTOT	0.120	0.114	0.118	0.122	0.114	0.117	0.118	0.113	0.116	0.119	0.112	0.114
	(3.704)	(3.566)	(3.670)	(3.912)	(3.569)	(3.804)	(3.675)	(3.530)	(3.630)	(3.819)	(3.537)	(3.718)
VLTOT3	0.018						0.018					
	(0.334)						(0.340)					
VLTOT4		0.021						0.026				
		(0.361)						(0.459)				
VR3			-0.007	-0.011					0.000	-0.000		
			(-0.109)	(-0.163)					(0.007)	(-0.011)		
VR4					-0.046	-0.048					-0.040	-0.040
					(-0.550)	(-0.574)					(-0.478)	(-0.481)
DUMMY							0.005	0.004	0.004	0.005	0.005	0.005
							(1.724)	(1.588)	(1.575)	(1.623)	(1.626)	(1.672)
Adj. R2	0.940	0.940	0.940	0.941	0.940	0.941	0.941	0.941	0.941	0.941	0.941	0.942
Total panel Observations	219	219	219	219	219	219	219	219	219	219	219	219
Standard error of regression	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.053

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade weighted by the ratio of real exports to real GDP, obtained by non-parametric filtering method. RLTOT is the residual component of terms of trade weighted by the ratio of real exports to real GDP, obtained by non-parametric filtering method. VLTOT3 is the volatility measure as the standard deviation of weighted terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than $LTOT_{t-1}$.

Table 7
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Unweighted terms of trade, HP filter)

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(-1)	0.475	0.467	0.475	0.474	0.467	0.466
	(8.738)	(8.473)	(8.740)	(8.730)	(8.472)	(8.463)
RSF%GDP	-0.125	-0.133	-0.125	-0.123	-0.134	-0.133
	(-1.996)	(-2.099)	(-1.996)	(-1.985)	(-2.112)	(-2.125)
RINFL	-0.033	-0.031	-0.033		-0.030	
	(-0.612)	(-0.562)	(-0.605)		(-0.547)	
LGNPPC	0.085	0.105	0.085	0.100	0.105	0.121
	(2.367)	(2.791)	(2.368)	(2.898)	(2.784)	(3.334)
RGNPGR	0.082	0.084	0.082		0.082	
	(1.193)	(1.223)	(1.197)		(1.181)	
RSG%GDP	-0.601	-0.609	-0.601	-0.591	-0.613	-0.604
	(-6.930)	(-6.968)	(-6.907)	(-6.867)	(-7.016)	(-6.988)
M2%GDP	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(-3.715)	(-4.073)	(-3.722)	(-3.874)	(-4.052)	(-4.184)
LTOT	0.003	-0.003	0.004	0.002	-0.006	-0.010
	(0.071)	(-0.074)	(0.083)	(0.049)	(-0.135)	(-0.218)
RLTOT	0.083	0.092	0.084	0.090	0.090	0.097
	(2.633)	(2.871)	(2.669)	(2.909)	(2.835)	(3.090)
VLTOT3	0.052					
	(0.750)					
VLTOT4		0.122				
		(1.598)				
VR3			0.035	0.048		
			(0.474)	(0.671)		
VR4					0.120	0.144
					(1.360)	(1.676)
DUMMY2	0.005	0.006	0.005	0.005	0.006	0.006
	(2.394)	(2.431)	(2.392)	(2.355)	(2.454)	(2.442)
Adj. R2	0.931	0.932	0.931	0.931	0.932	0.932
Total panel Observations	283	279	283	283	279	279
Standard error of regression	0.055	0.055	0.055	0.055	0.055	0.055

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade, obtained by Hodrick-Prescott filter method. RLTOT is the residual component of terms of trade, obtained by Hodrick-Prescott filter method. VLTOT3 is the volatility measure as the standard deviation of terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY2 is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than both the mean of LTOT and $LTOT_{t-1}$.

Table 8
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Unweighted terms of trade, Optimum lambda filter)

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(-1)	0.518	0.515	0.518	0.520	0.516	0.517
	(8.537)	(8.413)	(8.546)	(8.676)	(8.408)	(8.530)
RSF%GDP	-0.110	-0.110	-0106	-0.097	-0.107	-0.098
	(-1.548)	(-1.543)	(-1.494)	(-1.386)	(-1.495)	(-1.398)
RINFL	-0.046	-0.045	-0.049		-0.047	
	(-0.719)	(-0.695)	(-0.761)		(-0.730)	
LGNPPC	0.173	0.175	0.170	0.182	0.173	0.186
	(3.673)	(3.672)	(3.641)	(4.148)	(3.640)	(4.186)
RGNPGR	0.029	0.039	0.024		0.032	
	(0.345)	(0.468)	(0.294)		(0.400)	
RSG%GDP	-0628	-0.619	-0.624	-0.630	-0.620	-0.625
	(-6.428)	(-6.284)	(-6.407)	(-6.528)	(-6.316)	(-6.432)
M2%GDP	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(-4.428)	(-4.397)	(-4.445)	(-4.612)	(-4.415)	(-4.595)
LTOT	-0.044	-0.044	-0.041	-0.039	-0.043	-0.041
	(-0.749)	(-0.739)	(-0.700)	(-0.677)	(-0.718)	(-0.718)
RLTOT	0.108	0.103	0.115	0.116	0.107	0.108
	(3.323)	(3.192)	(3.519)	(3.762)	(3.269)	(3.496)
VLTOT3	-0.027					
	(-0.338)					
VLTOT4		0.071				
		(0.799)				
VR3			-0.039	-0.031		
			(-0.448)	(-0.367)		
VR4					0.069	0.078
					(0.673)	(0.775)
DUMMY2	0.006	0.005	0.006	0.007	0.005	0.006
	(2.033)	(1.776)	(2.085)	(2.216)	(1.790)	(1.917)
Adj. R2	0.936	0.935	0.936	0.936	0.935	0.936
Total panel Observations	224	224	224	224	224	224
Standard error of regression	0.056	0.056	0.056	0.055	0.056	0.056

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade, obtained by optimum lambda filtering method. RLTOT is the residual component of terms of trade, obtained by optimum lambda filtering method. VLTOT3 is the volatility measure as the standard deviation of terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY2 is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than both the mean of LTOT and $LTOT_{t-1}$.

Table 9
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Unweighted terms of trade, Non-parametric filter)

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(-1)	0.505	0.502	0.504	0.506	0.503	0.505
	(8.051)	(7.949)	(8.041)	(8.221)	(7.988)	(8.143)
RSF%GDP	-0.128	-0.126	-0.126	-0.116	-0.124	-0.115
	(-1.801)	(-1.778)	(-1.763)	(-1.669)	(-1.734)	(-1.652)
RINFL	-0.042	-0.040	-0.045		-0.042	
	(-0.677)	(-0.641)	(-0.724)		(-0.670)	
LGNPPC	0.144	0.150	0.142	0.153	0.146	0.158
	(3.336)	(3.430)	(3.318)	(3.806)	(3.379)	(3.911)
RGNPGR	0.041	0.048	0.035		0.042	
	(0.505)	(0.593)	(0.442)		(0.528)	
RSG%GDP	-0.642	-0.634	-0.638	-0.645	-0.636	-0.642
	(-6.473)	(-6.335)	(-6.456)	(-6.598)	(-6.411)	(-6.540)
M2%GDP	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(-4.665)	(-4.646)	(-4.716)	(-4.900)	(-4.672)	(-4.861)
LTOT	-0.020	-0.023	-0.017	-0.020	-0.020	-0.024
	(-0.401)	(-0.453)	(-0.331)	(-0.392)	(-0.395)	(-0.471)
RLTOT	0.107	0.104	0.115	0.121	0.109	0.115
	(2.846)	(2.769)	(3.024)	(3.303)	(2.863)	(3.137)
VLTOT3	-0.003					
	(-0.042)					
VLTOT4		0.082				
		(0.937)				
VR3			-0.014	-0.005		
			(-0.181)	(-0.072)		
VR4					0.067	0.080
					(0.705)	(0.859)
DUMMY2	0.005	0.005	0.005	0.005	0.005	0.005
	(1.972)	(1.886)	(1.964)	(1.959)	(1.918)	(1.917)
Adj. R2	0.936	0.935	0.936	0.936	0.935	0.936
Total panel Observations	224	224	224	224	224	224
Standard error of regression	0.056	0.056	0.056	0.055	0.056	0.056

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade, obtained by non-parametric filtering method. RLTOT is the residual component of terms of trade, obtained by non-parametric filtering method. VLTOT3 is the volatility measure as the standard deviation of terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY2 is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than both the mean of LTOT and $LTOT_{t-1}$.

Table 10
Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96
Instrumental Variable Method with Fixed Effects
(Weighted terms of trade, HP filter)

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(-1)	0.460	0.454	0.459	0.456	0.454	0.452
	(8.675)	(8.434)	(8.627)	(8.577)	(8.363)	(8.324)
RSF%GDP	-0.111	-0.116	-0.111	-0.113	-0.115	-0.118
	(-1.802)	(-1.861)	(-1.808)	(-1.847)	(-1.841)	(-1.908)
RINFL	-0.010	-0.006	-0.015		-0.010	
	(-0.176)	(-0.108)	(-0.265)		(-0.179)	
LGNPPC	0.090	0.095	0.088	0.102	0.094	0.109
	(2.644)	(2.725)	(2.574)	(3.159)	(2.693)	(3.275)
RGNPGR	0.088	0.098	0.090		0.101	
	(1.291)	(1.431)	(1.316)		(1.469)	
RSG%GDP	-0.595	-0.602	-0.595	-0.579	-0.601	-0.584
	(-7.060)	(-7.061)	(-7.034)	(-6.999)	(-7.049)	(-6.999)
M2%GDP	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(-3.850)	(-4.093)	(-3.799)	(-3.949)	(-4.065)	(-4.179)
LTOT	-0.009	-0.002	-0.009	-0.009	-0.003	-0.005
	(-0.261)	(-0.063)	(-0.251)	(-0.263)	(-0.088)	(-0.144)
RLTOT	0.110	0.107	0.108	0.112	0.106	0.112
	(4.511)	(4.373)	(4.401)	(4.745)	(4.303)	(4.706)
VLTOT3	0.065					
	(1.294)					
VLTOT4		0.082				
		(1.501)				
VR3			0.100	0.099		
			(1.711)	(1.820)		
VR4					0.115	0.111
					(1.657)	(1.665)
DUMMY2	0.006	0.006	0.006	0.006	0.006	0.006
	(2.127)	(2.110)	(2.111)	(2.008)	(2.101)	(1.986)
Adj. R2	0.934	0.934	0.934	0.934	0.934	0.934
Total panel Observations	283	279	283	283	279	279
Standard error of regression	0.054	0.054	0.054	0.054	0.054	0.054

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade weighted by the ratio of real exports to real GDP, obtained by Hodrick-Prescott filter method. RLTOT is the residual component of terms of trade weighted by the ratio of real exports to real GDP, obtained by Hodrick-Prescott filter method. VLTOT3 is the volatility measure as the standard deviation of weighted terms of trade for the periods of t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY2 is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than both the mean of LTOT and $LTOT_{t-1}$.

Table 11

Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96

Instrumental Variable Method with Fixed Effects

(Weighted terms of trade, Optimum lambda filter)

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(-1)	0.473	0.474	0.477	0.475	0.480	0.479
	(7.720)	(7.736)	(7.772)	(7.832)	(7.800)	(7.875)
RSF%GDP	-0.173	-0.182	-0.169	-0.168	-0.178	-0.178
	(-2.250)	(-2.347)	(-2.192)	(-2.201)	(-2.292)	(-2.308)
RINFL	-0.007	-0.005	-0.012		-0.013	
	(-0.100)	(-0.083)	(-0.181)		(-0.186)	
LGNPPC	0.197	0.194	0.194	0.202	0.190	0.196
	(4.331)	(4.304)	(4.323)	(4.838)	(4.255)	(4.744)
RGNPGR	0.028	0.017	0.029		0.023	
	(0.356)	(0.220)	(0.379)		(0.292)	
RSG%GDP	-0.633	-0.624	-0.633	-0.633	-0.628	-0.629
	(-6.685)	(-6.619)	(-6.664)	(-6.826)	(-6.610)	(-6.784)
M2%GDP	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(-5.205)	(-5.202)	(-5.180)	(-5.409)	(-5.132)	(-5.366)
LTOT	-0.015	-0.012	-0.019	-0.018	-0.017	-0.016
	(-0.351)	(-0.272)	(-0.429)	(-0.451)	(-0.399)	(-0.404)
RLTOT	0.112	0.109	0.113	0.115	0.111	0.112
	(4.585)	(4.515)	(4.642)	(4.891)	(4.567)	(4.813)
VLTOT3	0.018					
	(0.332)					
VLTOT4		0.019				
		(0.338)				
VR3			0.020	0.020		
			(0.337)	(0.360)		
VR4					0.017	0.018
					(0.264)	(0.281)
DUMMY2	0.006	0.006	0.006	0.006	0.006	0.006
	(1.609)	(1.622)	(1.635)	(1.648)	(1.651)	(1.667)
Adj. R2	0.941	0.941	0.941	0.942	0.941	0.942
Total panel Observations	219	219	219	219	219	219
Standard error of regression	0.053	0.053	0.053	0.053	0.054	0.053

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade weighted by the ratio of real exports to real GDP, obtained by optimum lambda filtering method. RLTOT is the residual component of terms of trade weighted by the ratio of real exports to real GDP, obtained by optimum lambda filtering method. VLTOT3 is the volatility measure as the standard deviation of weighted terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY2 is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than both the mean of LTOT and $LTOT_{t-1}$.

Table 12

Sub-Saharan African Countries: Determinants of the Private Savings Rate, 1980-96

Instrumental Variable Method with Fixed Effects

(Weighted terms of trade, Non-parametric filter)

	(1)	(2)	(3)	(4)	(5)	(6)
SP%GDP(-1)	0.478	0.479	0.483	0.478	0.485	0.481
	(7.740)	(7.750)	(7.788)	(7.799)	(7.840)	(7.858)
RSF%GDP	-0.180	-0.190	-0.178	-0.179	-0.191	-0.193
	(-2.320)	(-2.429)	(-2.276)	(-2.322)	(-2.445)	(-2.496)
RINFL	0.019	0.020	0.003		0.005	
	(0.295)	(0.307)	(0.052)		(0.091)	
LGNPPC	0.185	0.183	0.183	0.192	0.186	0.193
	(4.049)	(4.025)	(4.056)	(4.552)	(4.133)	(4.612)
RGNPGR	0.055	0.044	0.054		0.049	
	(0.709)	(0.564)	(0.710)		(0.642)	
RSG%GDP	-0.610	-0.602	-0.603	-0.595	-0.610	-0.603
	(-6.374)	(-6.313)	(-6.308)	(-6.408)	(-6.377)	(-6.486)
M2%GDP	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
	(-5.221)	(-5.221)	(-5.254)	(-5.418)	(-5.348)	(-5.518)
LTOT	0.049	0.051	0.049	0.049	0.052	0.051
	(0.818)	(0.888)	(0.836)	(0.902)	(0.932)	(1.003)
RLTOT	0.115	0.110	0.114	0.118	0.110	0.114
	(3.561)	(3.419)	(3.524)	(3.773)	(3.424)	(3.669)
VLTOT3	0.018					
	(0.337)					
VLTOT4		0.020				
		(0.353)				
VR3			-0.000	-0.004		
			(-0.006)	(-0.062)		
VR4					-0.045	-0.047
					(-0.541)	(-0.565)
DUMMY2	0.003	0.004	0.003	0.003	0.003	0.003
	(1.240)	(1.252)	(1.080)	(1.046)	(1.227)	(1.201)
Adj. R2	0.940	0.940	0.940	0.941	0.941	0.941
Total panel Observations	219	219	219	219	219	219
Standard error of regression	0.054	0.054	0.054	0.054	0.054	0.054

Note: t-statistics are in parentheses. Private saving rate (SP%GDP) is the ratio of private saving to GDP. SP%GDP(-1) is the lagged value of SP%GDP. RSF%GDP and RINFL, RGNPGR and RSG%GDP are the instrumental variables used for SF%GDP, INFL, GNPGR and SG%GDP, successively (SF%GDP is the ratio of foreign savings to GDP; INFL is the inflation rate in terms of the GDP deflator; GNPGR is the growth rate of the real GNP per capita; SG%GDP is the ratio of general government saving to GDP). LGNPPC is the log of real GNP per capita in constant US dollars. M2%GDP is the ratio of M2 to GDP. LTOT is the trend component of terms of trade weighted by the ratio of real exports to real GDP, obtained by non-parametric filtering method. RLTOT is the residual component of terms of trade weighted by the ratio of real exports to real GDP, obtained by non-parametric filtering method. VLTOT3 is the volatility measure as the standard deviation of weighted terms of trade for periods t-2, t-1 and t, and VLTOT4 is for the period t-3, t-2, t-1 and t. VR3 and VR4 are the volatility measures of RLTOT for the period of t-2, t-1 and t, and t-3, t-2, t-1 and t, successively. DUMMY2 is the dummy variable equal to 1 times LTOT whenever $LTOT_t$ is greater than both the mean of LTOT and $LTOT_{t-1}$.

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